CLAIMS

What is claimed is:

1. An assay method comprising:

providing a sample that is suspected of containing a target polynucleotide;

providing a polycationic multichromophore that interacts with the target polynucleotide and upon excitation is capable of transferring energy to a signaling chromophore;

providing a sensor polynucleotide binding protein (PBP) that can bind to the target polynucleotide, said sensor PBP conjugated to the signaling chromophore;

contacting the sample with the sensor PBP and the multichromophore in a solution under conditions in which the sensor PBP can bind to the target polynucleotide, if present;

applying a light source to the solution that can excite the multichromophore; and

detecting whether light is emitted from the signaling chromophore.

2. The method of claim 1, wherein the multichromophore comprises a structure selected from a saturated polymer, a conjugated polymer, a dendrimer, and a semiconductor nanocrystal.

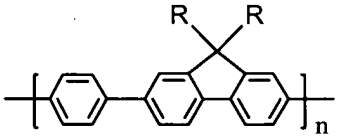
3. The method of claim 2, wherein the multichromophore comprises a saturated polymer.

4. The method of claim 2, wherein the multichromophore comprises a dendrimer.

5. The method of claim 2, wherein the multichromophore comprises a semiconductor nanocrystal.

6. The method of claim 2, wherein the multichromophore comprises a conjugated polymer.

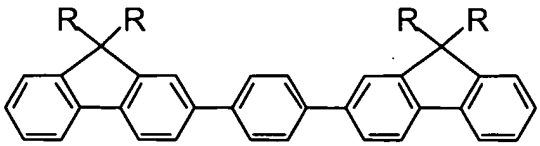
7. The method of claim 6, wherein the conjugated polymer has the structure



3 R= $-(CH_2)_6\overset{+}{N}Me_3\overset{-}{I}$

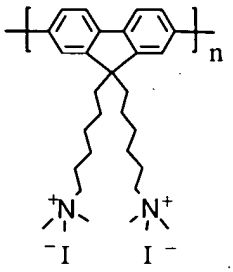
where n=2 -100,000.

8. The method of claim 6, wherein the conjugated polymer has the structure



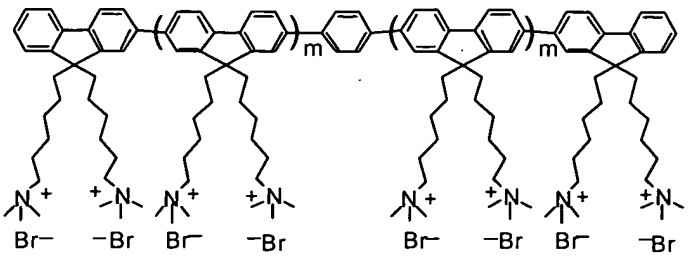
4 -R = $-(CH_2)_6\overset{\oplus}{N}Me_3\overset{\ominus}{I}$

9. The method of claim 6, wherein the conjugated polymer has the structure



where n=2-100,000.

10. The method of claim 6, wherein the conjugated polymer has the structure



where m = 1 or 2.

11. The method of claim 1, wherein the sample is contacted with approximately a 1:1 charge ratio of the sensor PBP and the multichromophore.

12. The method of claim 1, wherein the sample is contacted with the sensor PBP and the multichromophore in the presence of a sufficient amount of an organic solvent to decrease hydrophobic interactions between the sensor PBP and the multichromophore.

13. The method of claim 1, wherein the sample is contacted with a plurality of different sensor PBPs, said different sensor PBPs comprising a corresponding different signaling chromophore, wherein each of said different sensor PBPs can selectively bind to a corresponding different target polynucleotide.

14. The method of claim 1, wherein the chromophore is a fluorophore.

15. The method of claim 14, wherein the fluorophore is selected from a semiconductor nanocrystal, a fluorescent dye, and a lanthanide chelate.

16. The method of claim 15, wherein the fluorophore is a semiconductor nanocrystal.

17. The method of claim 15, wherein the fluorophore is a fluorescent dye.

18. The method of claim 17, wherein the fluorescent dye is fluorescein.

19. The method of claim 17, wherein the fluorophore is a lanthanide chelate.

20. The method of claim 1, wherein the target polynucleotide is DNA.

21. The method of claim 1, wherein the target polynucleotide is RNA.

22. The method of claim 1, wherein the sample comprises single-stranded target polynucleotide.

23. The method of claim 1, wherein the sample comprises double-stranded target polynucleotide.

24. The method of claim 1, wherein the target polynucleotide is produced via an amplification reaction.

25. A polynucleotide sensing solution comprising:

a sensor polynucleotide binding protein (PBP) that binds to a target polynucleotide, said sensor PBP attached to a signaling chromophore;

a polycationic multichromophore that can electrostatically interact with the target polynucleotide and is capable of transferring energy to the signaling chromophore upon excitation when brought into proximity thereto upon binding of the sensor PBP to the target polynucleotide.

26. A kit for assaying a sample for a target polynucleotide comprising:

a sensor PBP that can bind to the target polynucleotide;

a polycationic multichromophore that can electrostatically interact with the target polynucleotide and is capable of transferring energy to the signaling chromophore upon excitation when brought into proximity thereto upon binding of the sensor PBP to the target polynucleotide;

a housing for retaining the sensor PBP and multichromophore; and

instructions provided with said housing that describe how to use the components of the kit to assay the sample for the target polynucleotide.

27. The method of claim 1, wherein light emitted from the signaling chromophore above a threshold level indicates that the target polynucleotide is present in the sample.

28. The method of claim 1, wherein the amount of light emitted from the signaling chromophore is quantitated and used to determine the amount of the target polynucleotide in the sample.

29. The method of claim 12, wherein the fluorophore is a green fluorescent protein.

30. The method of claim 1, wherein the target polynucleotide is not amplified.